

These are NOT the adopted CDE revised standards, but are a draft version of the revised CO Standards showing how the AASL and ISTE benchmarks could be adapted and embedded in the standards. The additions are shown in **RED**

Physical Science

Students know and understand common properties, forms, and changes in matter and energy.

Prepared Graduate Competencies

The Prepared Graduate Competencies are the Preschool through Grade 12 concepts and skills that all students leaving the Colorado education system must have to ensure success in a postsecondary and workforce setting.

Prepared Graduate Competencies in the Physical Science standard:

- Observe, explain, and predict natural phenomena governed by Newton's Laws of Motion acknowledging the limitations of their application to very small or very fast objects
- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions
- Apply an understanding that energy exists in various forms and its transformation and conservation occur in processes that are predictable and measurable

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain, and predict natural phenomena governed by Newton's Laws of Motion acknowledging the limitations of their application to very small or very fast objects

High School Expectation

Concepts and skills students know include:

1. Newton's laws of motion and gravitation describe the relationships among forces acting on and between objects, their masses, and changes in their motion, but has limitations

Evidence Outcomes

Students can:

- a. Gather, analyze and interpret data and create graphs regarding position, velocity and acceleration of moving objects
- b. Develop, communicate, and justify an evidence-based analysis of the forces acting on an object and the resultant acceleration produced by a net force
- c. Develop, communicate, and justify an evidence-based scientific prediction regarding the effects of the action-reaction force pairs on the motion of two interacting objects
- d. Examine the effect of changing masses and distance when applying Newton's law of universal gravitation to a system of two bodies
- e. Identify the limitations of Newton's laws in extreme situations

21st Century Skills and Readiness Competencies

Inquiry:

- How can forces be acting on an object without changing its motion?
- Why do equal but opposite action/reaction forces not cancel?

Applying Science in Society and Using Technology:

- Students will apply the concepts of Newton's Laws to a variety of situations including vehicle safety, aerospace, bridge design, planetary motion, and other applications
- Analyze how forces in equilibrium lead to safe building designs and earthquake safe buildings
- Analyze the forces present on earth that leads to plate tectonics
- Students will apply the concepts of Newton's Laws to a variety of situations including vehicle safety, aerospace, bridge design, planetary motion, and other applications
- Use multiple technology tools and resources tools (e.g., digital cameras, graphing calculators, probes, handheld devices, and other emerging technologies) to measure and analyze how forces in equilibrium lead to safe building designs and earthquake safe buildings
- Use advanced features and utilities of spreadsheet software, (e.g. formulas, graphs and charts), to perform calculations and to organize, analyze and report data.

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| | <p>Nature of Science:</p> <ul style="list-style-type: none">• Design an experimental investigation and collect evidence in order to answer a testable question about an application of Newton’s Laws of motion• Share experimental data and respectfully discuss conflicting results, and analyze ways to minimize error and uncertainty in measurement• Differentiate between the use of the terms “law” and “theory” as they are defined and used in science compared to the way they are used in other disciplines or common use |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

High School Expectation

Concepts and skills students know include:

2. Matter has definite structure which determines characteristic physical and chemical properties

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation supporting the current model of an atom
- b. Gather, analyze and interpret data on chemical and physical properties of elements (ie. density, melting point, boiling point, conductivity)
- c. Use characteristic physical and chemical properties to develop predictions and supporting claims about elements' positions on the periodic table
- d. Develop a model that differentiates the following: atoms and molecules, elements and compounds, pure substances and mixtures

21st Century Skills and Readiness Competencies

Inquiry:

- What patterns can be observed in the properties of elements/families in the periodic table?
- What properties do nanoscale particles have that are different than those of macroscopic samples of the same substance?

Applying Science in Society and Using Technology:

- Identify properties of metalloids/semiconductors that make them useful in electronic applications
- Recognize that scientists create alloys by combining metals with other elements to produce materials with different properties
- Design a process by which a consumer can make an informed decision regarding the purchase of household chemicals
- Research the unique properties and challenges of designing nanoscale particles. What special benefits and dangers do they offer to society?
- **Use technology tools to create computer simulations and models of atoms and molecules, elements and compounds, pure substances and mixtures.**
- **Employ data-collection technology such as probes, handheld devices, and sensors to gather, view, analyze, and interpret data about chemical and physical properties of elements.**

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| | <p>Nature of Science:</p> <ul style="list-style-type: none">Recognize the current understandings of molecular structure related to the physical and chemical properties of matter has developed over time and has become more sophisticated as new technologies have led to new evidence |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

High School Expectation

Concepts and skills students know include:

3. Matter can change form through chemical or nuclear reactions abiding by the laws of conservation of mass and energy

Evidence Outcomes

Students can:

- a. Recognize, analyze, interpret and balance chemical (synthesis, decomposition, combustion and replacement) or nuclear (fusion and fission) equations
- b. Predict reactants and products for different types of chemical and nuclear reactions
- c. Predict the amount product produced in a reaction based on the amount of reactants

21st Century Skills and Readiness Competencies

Inquiry:

- What patterns of chemical reactions exist?
- How do you distinguish a chemical from a nuclear reaction?

Applying Science in Society and Using Technology:

- Explain how the products formed in different types of reactions are useful to people
- Explain how the societal use of chemicals which can react in the environment can have both positive and negative environmental effects
- **Seek and use a variety of specialized resources available from libraries, the Internet, and the community in order to** evaluate the benefits and dangers of the use of radioactive substances in medicine, energy production and other applications.
- **Employ data-collection technology such as probes, handheld devices, and sensors to gather, view, analyze, and interpret data produced during an experimental investigation to test predictions about chemical reactions.**

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| | Nature of Science: <ul style="list-style-type: none">• Critically evaluate the use of models in representing chemical and nuclear change, identifying the strengths and weaknesses of the model in representing complex natural phenomena• Design an experimental investigation to test predictions about chemical reactions• Share experimental data and respectfully discuss conflicting results, describing their work as emulating the practice of scientists• Recognize and describe the ethical traditions of science: value peer review, truthful reporting of methods and outcomes, making work public, and sharing a lens of professional skepticism when reviewing others work |
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Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

High School Expectation

Concepts and skills students know include:

4. Atoms join together with different types of bonds to form different types of compounds that have different properties

Evidence Outcomes

Students can:

- Develop, communicate, and justify an evidence-based scientific explanation supporting the current models of chemical bonding
- Gather, analyze and interpret data on chemical and physical properties of different compounds (e.g., density, melting point, boiling point, pH, conductivity)
- Use characteristic physical and chemical properties to develop predictions and supporting claims about compounds' classification as ionic, polar or covalen
- Predict the type of bonding that will occur between elements based on their position in the periodic table

21st Century Skills and Readiness Competencies

Inquiry:

- How can various substances be classified as ionic or covalent compounds?
- What role do electrons play in different types of chemical bonds?

Applying Science in Society and Using Technology:

- Explain how related compounds may share some properties.
- Recognize that the ability of carbon atoms to bond in many ways provides the foundation for a wide range of applications, from large molecules essential to life, to the development of synthetic polymers and oils
- Investigate how living systems create and use various chemical compounds
- **Employ data-collection technology such as probes, handheld devices, and sensors to gather, view, analyze, and interpret data about chemical and physical properties of different compounds (e.g., density, melting point, boiling point, pH, conductivity)**
- **Use locally available and web-based interactive presentation and production tools in order to effectively organize and communicate an evidence-based scientific explanation supporting the current models of chemical bonding.**

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| | Nature of Science: <ul style="list-style-type: none">Recognize the current understandings of molecular structure related to the physical and chemical properties of matter has developed over time and has become more sophisticated as new technologies have led to new evidence |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding that energy exists in various forms and its transformation and conservation occur in processes that are predictable and measurable

High School Expectation

Concepts and skills students know include:

5. There are many ways of describing energy: potential or kinetic; mechanical energy, electrical, chemical, nuclear, light and heat

Evidence Outcomes

Students can:

- a. Develop, communicate and justify an evidence based scientific explanation regarding the potential or kinetic nature of a type of mechanical energy
- b. Gather, analyze and interpret data on the quantity of energy in a system or object using appropriate measurements, equations and graphs
- c. Use direct and indirect evidence to develop predictions of the types of energy associated with objects
- d. identify different energy forms and calculate their amounts by measuring their defining characteristics

21st Century Skills and Readiness Competencies

Inquiry:

- What factors can be measured to determine the amount of energy associated with an object?
- What are the most common forms of energy in our physical world?
- What makes an energy form "renewable or non-renewable"?
- What makes some forms of energy hard to measure?

Applying Science in Society and Using Technology:

- Conduct a cost/benefit analysis of different ways of providing electricity to our society
- Design a system that converts wind energy into another form of energy
- Investigate the advantages and disadvantages of various energy sources as transportation fuel
- Investigate the role politics plays in energy policy
- Investigate the role energy plays in living systems and earth systems
- Address real-world energy problems and issues by using information and communication technology tools to gather, evaluate, and use information from different sources, analyze findings, draw conclusions, and create solutions.
- Participate responsibly and safely in social networks using appropriate tools to collaborate as well as share ideas and knowledge about energy issues in society.

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| | <p>Nature of Science:</p> <ul style="list-style-type: none">• Critically evaluate scientific claims made in popular media or by peers regarding application of energy forms and determine if the evidence presented is appropriate and sufficient to support the claims• Consider the historical context and impact of early energy research and the potential implications for current energy studies on science and our society |
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Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding that energy exists in various forms and its transformation and conservation occur in processes that are predictable and measurable

High School Expectation

Concepts and skills students know include:

6. Energy can be transformed through a variety of mechanisms; in any transformation, energy is neither created nor destroyed, but transformation of some energy to heat reduces the efficiency of the transformations

Evidence Outcomes

Students can:

- a. Use direct and indirect evidence in developing and supporting claims about the conservation of energy in a variety of systems, including transformations to heat
- b. Evaluate the energy conversion efficiency of a variety of energy

21st Century Skills and Readiness Competencies

Inquiry:

- Why can 100% efficiency impossible in an energy transformation?
- How does the Law of Conservation of Energy help us solve problems involving complex systems?
- Scientists or engineers often say energy is "lost." Is there a word that might be better than "lost?" Why?

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| <p>transformations</p> <p>c. Describe energy transformations both quantitatively and qualitatively</p> <p>d. Differentiate between the characteristics of mechanical and electromagnetic waves that determine their energy</p> | <p>Applying Science in Society and Using Technology:</p> <ul style="list-style-type: none"> • Seek and use a variety of specialized resources available from libraries, the Internet, and the community in order to investigate the strides made in improving the efficiency of different forms of energy production and consumption • Identify transformations of energy to heat in daily activities and generate strategies to reduce the heat produced • Investigate the difference in efficiency and environmental impact in LED, CFL, incandescent, and other light sources • Employ data-collection technology such as probes, handheld devices, and sensors to gather, view, analyze, and interpret data produced from scientific investigations of energy transformations • Select and use technology tools (e.g. spreadsheet software, graphing calculator, handheld devices) to analyze and process data and report results about different types of energy transformations. <p>Nature of Science:</p> <ul style="list-style-type: none"> • Critically evaluate scientific claims made in popular media or by peers regarding application of energy transformations and determine if the evidence presented is appropriate and sufficient to support the claims • Formulate a testable, falsifiable questions question about the conservation of energy and design a method to find the answer • Share experimental data and respectfully discuss conflicting results, describing their work as emulating the practice of scientist |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding that energy exists in various forms and its transformation and conservation occur in processes that are predictable and measurable

Eighth Grade Expectation

Concepts and skills students know include:

1. Recognize waves have unique characteristics and properties (electromagnetic, sound, seismic, and water)

Evidence Outcomes

Students can:

- a. Compare and contrast different types of waves
- b. Describe for various waves amplitude, frequency, wavelength, and speed
- c. Describe the relationship between pitch and frequency in sound
- d. Develop and design a scientific investigation regarding absorption, reflection, and refraction of light

21st Century Skills and Readiness Competencies

Inquiry:

- What are some different ways to describe waves?

Applying Science in Society and Using Technology:

- Describe why a low pitch vs. high pitch guitar string feels different to the touch when it is vibrating
- Explain why higher frequency waves have shorter wavelengths, what challenges does this present to design (ie. ships, buildings, antenna)
- Describe how the energy of different types of waves can affect the environment
- Investigate the various applications of light and lasers
- **Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media to investigate** how living organisms collect and use light and sound waves to gather information about their surroundings and the technologies used to correct or enhance these senses
- **Employ data-collection technology such as probes, sensors and handheld devices to gather, view, analyze, and report results for scientific investigations about the characteristics and properties of waves**
- **Select and use technology tools (e.g. spreadsheet software, graphing calculator, handheld devices) to analyze and process data and report results.**

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| | Nature of Science: <ul style="list-style-type: none">• Evaluate models used to explain and predict wave phenomena that cannot be directly measured• Understand that scientists work from the assumption that the universe is a single system in which the basic rules are the same everywhere (e.g., energy behaves the same all across the universe) |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain, and predict natural phenomena governed by Newton's Laws of Motion acknowledging the limitations of their application to very small or very fast objects

Eighth Grade Expectation

Concepts and skills students know include:

2. Identify and calculate the direction and the magnitude of forces acting on an object to explain the resultant change in its motion

Evidence Outcomes

Students can:

- a. Predict and evaluate the movement of an object by examining the forces applied to it
- b. Use mathematical expressions to describe the movement of an object
- c. Develop and design a scientific investigation to collect and analyze speed and acceleration data in order to determine the net forces acting on a moving object

21st Century Skills and Readiness Competencies

Inquiry:

- What relationship(s) exists between force, mass, speed, and acceleration?
- What evidence tells you a force has acted on a system? Is it possible for a force to act on a system without having an effect?

Applying Science in Society and Using Technology:

- Explore how engineers take g-forces into account when designing moving objects (for example: car tires, roller coasters, and rockets)
- Design a vehicle and its propulsion system using Newton's laws of motion
- **Employ data-collection technology such as probes and handheld devices to gather, view, analyze, and report results for scientific investigations of Newton's laws of motion**
- **Explore the application of Newton's laws of motion by using social networking technology tools to exchange data collected, collaborate to design products and solve problems by communicating with peers, experts, and other audiences.**

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| | <p>Nature of Science:</p> <ul style="list-style-type: none">• Recognize that our current understandings about forces has developed over centuries of studies by many scientists, and that through continued scientific investigations and advances in data collection we will continue to refine our understandings of forces• Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases in order to answer scientific questions about motion and acceleration |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Eighth Grade Expectation

Concepts and skills students know include:

3. Mixtures of substances can be separated based on their properties (for example: solubility, boiling points, magnetic properties and densities)

Evidence Outcomes

Students can:

- Identify properties of substances in a mixture that could be used to separate those substance from each other
- Develop and design a scientific investigation to separate the components of a mixture

21st Century Skills and Readiness Competencies

Inquiry:

- What techniques can be used to separate mixtures of substances based their properties?
- Which properties are the most useful in trying to separate mixtures of substances?
- How much difference must there be between the properties of substances in order for the properties to be useful in separating the substances?

Applying Science in Society and Using Technology:

- Design a water filtration system that relies on the solubility, density, and physical size of substances for filtering
- Explain how recycling plants can use the properties of materials to separate out substances in single stream recycling systems
- Investigate how mining and oil refining processes use properties to perform separation of materials
- **Employ data-collection technology such as probes, sensors and handheld devices to gather, view, analyze, and report results for scientific investigations designed to test and predict the properties of substances in mixtures.**
- **Use interactive technology tools to participate as a group in analyzing and critiquing experimental procedures designed to separate mixtures.**

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| | Nature of Science: <ul style="list-style-type: none">• Formulate testable, falsifiable inquiry questions about using properties to do separations and design a method to find an answer• Evaluate and critique experimental procedures designed to separate mixtures• Share experimental data and respectfully discuss inconsistent results• Describe several ways in which scientists would study mixtures and suggest ways that this has contributed to our understandings about materials |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Eighth Grade Expectation

Concepts and skills students know include:

4. Distinguish between physical and chemical changes, noting that mass is conserved during any change

Evidence Outcomes

Students can:

- a. Identify the distinguishing characteristics between a chemical and a physical change
- b. Gather, analyze and interpret data on physical and chemical changes.
- c. Gather, analyze and interpret data that mass is conserved in a given chemical or physical change
- d. Identify evidence that suggests that matter is always conserved in physical and chemical changes

21st Century Skills and Readiness Competencies

Inquiry:

- What evidence can tell us whether a change is physical or chemical?
- Is it easier to observe the conservation of mass in physical or chemical changes? Why?
- What would happen if mass was not conserved?

Applying Science in Society and Using Technology:

- Show how freezing, thawing, and vaporization of our Earth's water provide examples of physical changes
- Research how an understanding of chemical changes have been used by humans to design various products
- Research and explain the physical and chemical changes included in the collection and refinement of natural resources
- Apply the concept of conservation of mass to living systems where waste products from some organisms are nutrients for others
- Investigate where the mass for living materials comes from and where it goes when organisms decompose
- **Employ data-collection technology such as probes, sensors and handheld devices to gather, view, analyze, and report results for scientific investigations designed to explore the characteristics of chemical and physical changes.**
- **Share experimental results, interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and social media.**

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| | Nature of Science: <ul style="list-style-type: none">• Evaluate the reproducibility of an experiment and critically examine conflicts in experimental results• Share experimental data and respectfully discuss inconsistent results, describing their work as emulating the practice of scientists• Collaborate to critically evaluate scientific claims made in popular media regarding the difference between physical and chemical changes and determine if the evidence presented is appropriate and sufficient to support the claims |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding that energy exists in various forms and its transformation and conservation occur in processes that are predictable and measurable

Seventh Grade Expectation

Concepts and skills students know include:

1. There are different forms of energy and those forms of energy can be changed from one form to another but total energy is conserved

Evidence Outcomes

Students can:

- a. Gather, analyze and interpret data to describe the different forms of energy and energy transfer
- b. Develop a research based analysis of different forms of energy and energy transfer
- c. Use research based models to describe energy transfer mechanisms and predict amounts of energy transferred

21st Century Skills and Readiness Competencies

Inquiry:

- Which forms of energy can be directly observed and which forms of energy must be inferred?
- What evidence supports the existence of potential and kinetic energy?
- Is there a limit to how many times energy can be transferred?

Applying Science in Society and Using Technology:

- Describe how accident investigation photos and measurements provide evidence of energy transfers during such events
- Identify when kinetic energy is often turned into heat (e.g., when applying brakes to a vehicle or during space vehicle re-entry)
- Apply the concept of energy transfers converting electricity is to light, heat, and kinetic energy in motors
- Describe various ways of producing electricity using both non-renewable and renewable sources
- **Employ data-collection technology such as probes, sensors and handheld devices to gather, view, analyze, and report results for scientific investigations designed to answer questions about energy transformations**
- **Select and use technology tools (e.g. graphing software, calculator, handheld devices) to analyze and process data and report results.**

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| | Nature of Science: <ul style="list-style-type: none">• Share experimental data and respectfully discuss conflicting results• Recognize and describe the ethical traditions of science: value peer review, truthful reporting of methods and outcomes, making work public, and sharing a lens of professional skepticism when reviewing others work• Reflect on and describe their work in class as it compares to the practice of professional scientists |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Sixth Grade Expectation

Concepts and skills students know include:

1. All matter is made up of atoms, which are far too small to see directly through a light microscope. The atoms of any element are alike but are different from atoms of other elements, giving them unique properties. Atoms themselves are made up of even smaller particles

Evidence Outcomes

Students can:

- a. Identify evidence that suggests there is a fundamental building block of matter
- b. Use the particle model of matter to visualize characteristics of different substances
- c. Find, evaluate, and select appropriate information from reference books, journals, magazines, online references, and databases in order to compare and contrast historical explanations for the nature of matter

21st Century Skills and Readiness Competencies

Inquiry:

- In science we often talk about "building blocks." What makes something a building block?

Applying Science in Society and Using Technology:

- Explain that atoms and the atomic model are the foundation for explaining all matter in our universe, and are the foundation for all of Chemistry
- Recognize and describe that living things are made up of the same matter as the rest of the universe
- **Employ data-collection technology such as probes, sensors, and handheld devices to gather, view, analyze, and report results for scientific investigations designed to answer scientific questions about the nature of matter.**
- **Use interactive technology tools to participate as a group in analyzing and organizing information.**
- **Use social media (e.g., email, blogs, wikis, discussion groups, etc.) to share research findings about historical explanations for the nature of matter and to publish information to various audiences.**

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| | <p>Nature of Science:</p> <ul style="list-style-type: none">• Use the writing process, a variety of media and/or technology tools to create models that explain the particle theory of matter• Paying attention to copyright provisions, work in groups to import and manipulate pictures, images, and charts in documents, presentations, and other creative products in order to effectively communicate an understanding of the particle model of matter. |
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Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Sixth Grade Expectation

Concepts and skills students know include:

2. Atoms may stick together in well-defined molecules or may be packed together in large arrays. Different arrangements of atoms into groups compose all substances

Evidence Outcomes

Students can:

- a. Demonstrate the similarities and differences between elements and compounds
- b. Identify evidence that suggests that atoms form into molecules that have different properties than the atoms that make them up

21st Century Skills and Readiness Competencies

Inquiry:

- Why do substances behave differently (e.g. water pours rapidly while syrup pours slowly)?

Applying Science in Society and Using Technology:

- Investigate how different arrangements of atoms provide different properties and that very small devices, are made up of large numbers of arranged groups of atoms, that perform a specific function
- **Employ data-collection technology such as probes, sensors and handheld devices to gather, view, analyze, and report results for scientific investigations designed to answer questions about molecular substances**
- **Use appropriate electronic media and formats to design and develop creative products that clearly and coherently display understanding of molecular theory**

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| | Nature of Science: <ul style="list-style-type: none">• Use models to show and understand how molecules are made of atoms• Investigate how our current understanding of matter has developed through centuries of scientific investigations |
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Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Sixth Grade Expectation

Concepts and skills students know include:

3. Distinguish between, explain, and apply the relationships among mass, weight, volume and density

Evidence Outcomes

Students can:

- a. Explain that the mass of an object does not change, but its weight changes based on the gravitational forces acting upon it
- b. Predict how changes in acceleration due to gravity will affect the mass and weight of an object
- c. Predict how mass, weight, and volume affect density
- d. Measure mass and volume and use these quantities to determine (calculate) density

21st Century Skills and Readiness Competencies

Inquiry:

- Which of the following is the best recommendation for a person trying to lose weight – reduce the number of calories he is eating, exercise more, go to the moon? Why?
- If weight and mass are not the same thing, why do people use the words interchangeably?
- Describe a situation in which mass would be the most useful information to know about an object? Weight? Volume? Density?

Applying Science in Society and Using Technology:

- **Select and use grade-level appropriate electronic reference materials and pre-selected Internet sites to** research and explain how the study of mass, weight and gravitational forces are critical for space travel (weightlessness) and for future visits and perhaps colonization of places like the Moon or Mars
- **Employ data-collection technology such as probes, sensors and handheld devices to gather, view, analyze, and report results for scientific investigations about the relationships among mass, weight, volume and density.**

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| | <p>Nature of Science:</p> <ul style="list-style-type: none">• Calculate the density of a sample, predict its ability to float or sink in a liquid of known density, design and perform the experiment and justify discrepancies in the experimental outcome• Formulate testable, falsifiable inquiry questions about density and design a method to find an answer |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Sixth Grade Expectation

Concepts and skills students know include:

4. The physical characteristics and changes of solid, liquid, gas states can be explained using the particulate model

Evidence Outcomes

Students can:

- a. Explain how the arrangement and motion of particles in a substance (i.e., water) determine its state
- b. Distinguish between changes in temperature and changes of state using the particle model of matter

21st Century Skills and Readiness Competencies

Inquiry:

- What determines whether matter is in the form of a solid, liquid or gas?
- What is the kinetic molecular theory and how does temperature affect the behavior of particles in a gas?

Applying Science in Society and Using Technology:

- Design models that show how molecular motion explains the physical characteristics of solids, liquids, and gasses
- **Employ data-collection technology such as probes, sensors and handheld devices to gather, view, analyze, and report results for scientific investigations designed to explore the relationship between changes of state and changes in temperature**
- **Select and use technology tools (e.g. chart maker in spreadsheet, calculator, graphing software) to analyze and process data and report results.**

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|--|--|
| | Nature of Science: <ul style="list-style-type: none">• Understand that models are developed to explain and predict molecular phenomena that cannot be directly observed• Understand and apply the difference between scientific laws, theories and hypotheses• Use models to help visualize what is happening at the molecular level during phase changes |
|--|--|

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Fifth Grade Expectation

Concepts and skills students know include:

1. Mixtures of matter can be created or separated regardless of how these mixtures are created or changed, the total weight/mass is the same as the sum of its parts

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify a procedure to separate simple mixtures based on physical properties
- b. Share evidence based conclusions and an understanding of the impact on the weight/mass of a mixture before and after it is separated into parts (could be liquid or gas)

21st Century Skills and Readiness Competencies

Inquiry:

- How do mixtures act similarly and or and differently from the original materials?
- What are some ways that mixtures can be separated?

Applying Science in Society and Using Technology:

- Explain how knowing the properties help determine how to separate mixtures
- **Select and use appropriate sources, including specialized reference sources and databases, to explore how** creating and separating mixtures allows humans to make materials that do not exist naturally
- Investigate how mixtures make up the earth
- **Use data collection tools and measuring devices to gather, organize, and analyze data in order to answer questions and test predictions about characteristics of mixtures**

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| | |
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| | Nature of Science: <ul style="list-style-type: none">• Support a scientific explanations using evidence and reasoning• Select an appropriate tool to conduct an experiment |
|--|--|

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding that energy exists in various forms and its transformation and conservation occur in processes that are predictable and measurable

Fourth Grade Expectation

Concepts and skills students know include:

1. Energy comes in many forms such as light, heat, sound , magnetic and electrical

Evidence Outcomes

Students can:

- a. Identify and describe the variety of energy sources
- b. Show that electricity in circuits requires a complete loop through which current can pass
- c. Describe the energy transformation that take place in electrical circuits where light, heat, sound and magnetic effects are produced

21st Century Skills and Readiness Competencies

Inquiry:

- How do we know that energy exists within a system such as in an electrical circuit?
- How can heat be transferred from one object to another?

Applying Science in Society and Using Technology:

- Use multiple resources, including print, electronic, and human, to locate information about different sources of energy, renewable and non renewable
- Describe how energy is used our society
- Create a plan to decrease electrical energy use for one week and evaluate the results
- Develop collaborative projects about energy issues with peers that can be shared electronically and can challenge other students to answer questions or give opinions adding to the content

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| | |
|--|--|
| | Nature of Science: <ul style="list-style-type: none">• Formulate a testable question about energy, design a method of finding the answer, collect data, and form a conclusion• Share results of experiments with others and respectfully discuss results that are not expected |
|--|--|

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Third Grade

Concepts and skills students know include:

1. Matter exists in different states (solids, liquids, and gases) and can change from one state to another by heating and cooling

Evidence Outcomes

Students can:

- a. Analyze and interpret observations about matter as it freezes and melts, and boils and condenses
- b. Develop, communicate, and justify an evidence-based scientific explanation around how heating and cooling affects changes in states of matter
- c. Identify the state of any sample of matter

21st Century Skills and Readiness Competencies

Inquiry:

- Where around the school would snow take the longest to melt? Why?

Applying Science in Society and Using Technology:

- Use word processing, drawing, and presentation, graphing and other productivity tools to illustrate how water is distributed on earth in its different forms (vapor, ice/glaciers, rivers, oceans (fresh or salt) and determine what water is available for human use
- With teacher guidance, use a variety of media and formats to create and edit products that communicate and justify an evidence-based scientific explanation around how heating and cooling affects changes in states of matter
- Conduct science experiments using digital instruments and measurement devices.

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| | |
|--|---|
| | Nature of Science: <ul style="list-style-type: none">• Formulate a testable question about the heating and cooling of a substance, design a method of finding the answer, collect data, and form a conclusion• Recognize the importance of keeping accurate observations and notes in science• Share results of experiments with others and respectfully discuss results that are not expected |
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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain, and predict natural phenomena governed by Newton's Laws of Motion acknowledging the limitations of their application to very small or very fast objects

Second Grade Expectation

Concepts and skills students know include:

1. Changes in speed or direction of motion are caused by forces (pushes and pulls)

Evidence Outcomes

Students can:

- a. Identify and predict how the direction or speed of an object may change due to an outside force
- b. Analyze and interpret observable data about the impact of forces on the motion of objects

21st Century Skills and Readiness Competencies

Inquiry:

- What do you need to know about a force to predict how it will change the motion of an object?
- Are there any forces that do NOT result in a change in motion of an object?

Applying Science in Society and Using Technology:

- Identify technologies we have created to make our lives easier (e.g., design of tires, bicycles, snow throwers, etc.) , because we know how forces can affect objects
- Apply relationships between force and changes in motion in many of our recreational activities
- With teacher guidance, use technology tools to create and present ideas about forces and motion (e.g. podcasts, simple slide show)
- working in a teacher-led whole group project, enter simple data into a spreadsheet to create a graph illustrating effects of forces on motion

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| | |
|--|--|
| | Nature of Science: <ul style="list-style-type: none">• Select appropriate tools for data collection• Design an experiment, identifying the constants and variables |
|--|--|

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

First Grade Expectation

Concepts and skills students know include:

1. Solids and liquids have unique properties that distinguish them

Evidence Outcomes

Students can:

- a. Analyze and interpret observations about solids and liquids and their unique properties
- b. Identify the similarities and differences of two or more groups of solids/liquids
- c. Sort solids and liquids based on their properties and justify your choice based on evidence

21st Century Skills and Readiness Competencies

Inquiry:

- What do all liquids have in common? What are some differences they can have and still be considered liquids?
- What do all solids have in common? What are some differences they can have and still be considered solids?
- What properties of liquids can be used to sort/classify them?
- What properties of solids can be used to sort/classify them?

Applying Science in Society and Using Technology:

- Explain that the properties of solids and liquids help us understand how to use matter (e.g., you would not build a bridge out of tissue)
- Describe some practical reasons for sorting/classifying liquids or solids?
- **With teacher guidance, use a variety of technologies to produce a digital presentation or product about similarities and differences of solids/liquids**
- **With teacher guidance, use software or online tools to record and organize information from scientific investigations about solids and liquids**

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|--|---|
| | Nature of Science: <ul style="list-style-type: none">• Share results of experiments with others• Recognize that observations are an important part of science |
|--|---|

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Observe, explain, and predict natural phenomena governed by Newton's Laws of Motion acknowledging the limitations of their application to very small or very fast objects

Kindergarten Expectation

Concepts and skills students know include:

1. Objects can move in a variety of ways. We can describe this movement as fast, slow, straight, and back and forth

Evidence Outcomes

Students can:

- a. Observe, investigate and describe how different objects move

21st Century Skills and Readiness Competencies

Inquiry:

- How can you change how fast or slow an object travels?
- How can you tell which objects will be easier or harder to move?

Applying Science in Society and Using Technology:

- Explain why you have to push harder to move your bike/skateboard/scooter as you go faster, or as you go up a hill
- Describe the motion of a student at play
- Interpret information about motion represented in pictures, illustrations, and simple charts.
- As a class, create a digital story about motion and forces

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| | |
|--|--|
| | Nature of Science: <ul style="list-style-type: none">• Recognize that scientists try to be clear and specific when they describe things• Share their observations with others being clear and precise like a scientist |
|--|--|

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Kindergarten Expectation

Concepts and skills students know include:

2. Objects can be sorted by their physical properties. These properties can be observed and measured

Evidence Outcomes

Students can:

- a. Observe, investigate and describe how objects can be sorted using their physical properties
- b. Justify why objects are sorted into categories

21st Century Skills and Readiness Competencies

Inquiry:

- Can objects ever belong in more than one group? How do you decide in which group they belong?

Applying Science in Society and Using Technology:

- Describe potential uses of a material based on its properties
- Describe how machines can be designed to sort things efficiently (e.g., coin sorting machines)

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Prekindergarten Expectation

Concepts and skills students know include:

1. Objects have properties and characteristics

Evidence Outcomes

Students can:

- a. Use senses to gather information about objects
- b. Make simple observations, predictions, explanations and generalizations based on real life experiences
- c. Collect, describe and record information through discussion, drawings and charts

21st Century Skills and Readiness Competencies

Inquiry:

- How are various objects similar and different?

Applying Science in Society and Using Technology:

- Use scientific tools in their investigations and play (i.e. magnets, magnifying glasses, scales, rulers, etc.)
- Interpret information about object properties and characteristics represented in pictures, illustrations, and simple charts.

Nature of Science:

- Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment)
- Show capacity for invention and imagination
- Ask questions based upon discoveries made while playing

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Content Area: Science

Standard: Physical Science

Prepared Graduate Competencies:

- Apply an understanding of atomic and molecular structure to explain the properties of matter and predict outcomes of chemical and nuclear reactions

Prekindergarten Expectation

Concepts and skills students know include:

2. There are cause and effect relationships in everyday experiences

Evidence Outcomes

Students can:

- a. Recognize and investigate cause and effect relationships in every day experiences (i.e. pushing, pulling, kicking, rolling, or blowing objects)

21st Century Skills and Readiness Competencies

Inquiry:

- How do various objects react differently to the same cause?

Applying Science in Society and Using Technology:

- Use scientific tools in their investigations and play (i.e. magnets, magnifying glasses, scales, rulers, etc.)

Nature of Science:

- Openness to and curiosity about new tasks and challenges (Predisposition to explore and experiment)
- Reflection and interpretation on cause and effect relationships

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